PSYCHE.

THE LARVAE OF THE AUSTRALIAN EUCLEIDAE.

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In looking over the figures of exotic lepidopterous larvae that have been published, I think one of the most curious and apparently inexplicable forms is the *Doratifera vulnerans* of Lewin. This Eucleid is described as possessing the power of everting eight little tufts of stinging spines which are concealed when the larva is not irritated. I was at a loss to imagine the origin or mechanism of this structure and it was therefore with much pleasure that I received from Mr. E. A. C. Olive of Queensland a specimen of a species showing the eversible spines.

The group seems confined to Australia. I have examined the descriptions of the species of India for anything analogous, but without success. The Indian larvae are similar to our own, the Sisyrosea type seeming to predominate, with a few Euclea-like and smooth forms (the latter not to be interpreted from the figures). There is nothing here to suggest the origin of the peculiar structure of the Australian larvae.

Kirby lists seventeen species of Eucleidae from Australia in eight genera, of which I have seen figures of five larvae of two genera. When all are known, it may be found that there are other types of larvae, but at present there is no evidence of this. The five figures show a neat gradation in characters, apparently representing one type. The one showing the greatest development of the peculiar eversible spines is Lewin's species. Scott figures four others in which this character gradually declines until the last species is without horns of any kind and has become a "smooth Eucleid." Evidently we have here a new type of smooth Eucleid, different from either of the North American ones, derived, I think, from the true Australian type. Therefore I consider the larva received from Mr. Olive as typical of the Australian Eucleidae.

Before describing the Australian species I will review the types already made known. These are all represented in North America. In Europe there are but two species, both belonging to one limited type which is better represented here. In Asia, Moore has figured a good

many species from India, but the figures are very rough and often inaccurate. In some as many as twenty side horns are shown, although these structures are segmentary and could not possibly exceed twelve (nine is the normal number). The figures serve only to give a general idea of the larvae and in the case of the smooth ones, where the structure is obscure, they are worthless in locating the forms.

The few South American species described belong to types represented with us. Therefore, with the exception of Australia, we have all the types as yet definitely made known.

The structure of the Eucleid larva is to be understood by starting from a larva like the Pyromorphid or European Anthrocerid (Zygaenid) or, still more exactly, the South American Megalopygid which has warts derived from tubercles i+ii, iii and iv+v. In the Eucleid the subventral area is reduced, owing to the formation of the creeping disk, and all the warts below the stigmatal region are obsolete. This leaves three warts on thorax and two on abdomen for the primitive form.

The warts are variously modified, two main tendencies appearing. First hypertrophy, resulting in appendages or horns as they are variously called (spined Eucleids); second atrophy, resulting in the smooth type.

Type 1 (Tropic hairy Eucleids.). Illustrated by Phobetron and Calybia. Three warts present on the thorax; the warts are hairy, not spined; the first stage shows single setae with an alternation of strong and weak segments which persists in later stages. We have here the original number of warts and a modified primitive first stage, followed by wart formation with relatively unmodified setae. This combination of generalized characters entitles this type to the lowest place. Following up this line of descent we have:—

Types 2 and 3 (Tropic spined Eucleids). Illustrated by Sibine, Euclea etc. Only two warts on thorax, the same as on abdomen. Horns spined, the simple setae present only in stage I and multiple: no sign of alternating weak and strong segments. We have the formation of spiny setae, the number of warts reduced, a crowding back of the simple-haired warts into stage I with loss of the primitive first stage. A distinctly higher type in all the characters enumerated. To this belong many of the Indian and South American species figured by authors.

Type 4 (Tropic smooth Eucleids). Illustrated by Eulimacodes. To return to the starting point for this new phylum there are three warts on the thorax, small warts present in stage I, afterwards single setae only by degeneration. We have atrophy of the warts superimposed upon a crowding back of the wart formation into stage I with loss of the primitive first stage.

Types 5 to 7 (Palaearctic smooth Eucleids). Illustrated by Apoda, Heterogenea and Packardia. The warts are absent, being reduced to single setae by degeneration. In stage I single setae are present, but modified and partly

united as in Phobetron, and showing an alternation of strong and weak segments. We have atrophy of the warts without the loss of the primitive first stage.

I class this type higher than type 4 because the warts have entirely disappeared and the structure is so modified that there is no evidence in the individual ontogeny of the derivation from wart-bearing ancestors; but it is difficult to compare the types exactly, as they are so diverse and have pursued such different lines of development. To this last type belong both the European species.

It might have been antecedently expected that the Australian type would prove to be an ancient one from consideration of the many other generalized animals found in that country, yet such is not the case. In fact the Australian Eucleids are distinctly specialized, belonging to the highest phylum of the horned larvae (type 3) and forming a peculiar branch of that phylum, as the following characters show: —

The horns (hypertrophied warts) are present in two rows, subdorsal on joints 3 to 13, lateral on joints 3, 4, 6 to 12; the spiracle on joint 5 moved up into the place of the missing horn; skin with irregular clear granules; caltrope spines present in little elliptical sunken patches at the bases of the lateral horns of joints 6 to 12 and subdorsal of 13. So far the larva stands just on a level with *Euclea indetermina* and *Adoneta spinuloides* which have no detachable spines, lower than *Euclea delphinii* and *Sibine stimulea* which have them and again higher than *Sisyrosea textula* and *S. nasoni** which do not possess caltropes.

The shape is elongated, spaces equal except the narrowed subventral space; feet as usual, the suckers showing distinctly on joints 5 to 11, apparently absent on 12 and 13. Thoracic feet small, distinct. The horns are unequal in length as in Euclea, but the inequality is a special one. There are besides two simultaneous modifications of the original stinging spines. These are, first, the formation of the retractile horns and, second, the conversion of the other horns into long smooth tentacles.

The first of these is indicated in some of our own species, as in *Sisyrosea nasoni*, where all the subdorsal horns of joints 4 to 12 can be depressed outward with convergence of all the spines to a point, or, more exactly in *Parasa chloris* where the subdorsal horns of joints 4, 5, 11 and 12 are bent in over the back with the spines not erected. In fact this rudimentary condition of Parasa represents exactly the beginnings of the structure of the Australian Eucleids. Not only is the structure similar, but it is the horns of the same segments that are thus affected. In *Doratifera vulnerans* Lewin the retractile horns are on joints 4, 5, 11, 12, while in *D. lewini* Scott and *D. casta* Scott they are on joints 4 and 5 only. The retractile horns consist of a short fleshy shaft with numerous spines which

* The larvae which I call *nasoni* have not yet been bred, hence the determination is not certain.

bend inward over the back, the spines becoming converged and the whole concealed by a triangular fold of skin. The presence of this fold is the only essential difference between these tufts of Doratifera and our Parasa. The muscular function may be slightly present in Parasa; it is certainly so in *Sisyrosea nasoni*, though in this case the horns bend outward.

The second modification is produced by the lengthening of the horn and the reduction of the stinging spines. I find on the tentacles of the larva sent me by Mr. Olive not only a few setae, but several distinctly formed, though very short stinging spines, as well as a great number of degenerate irregular lumps, representing the mass of the spines. In this larva the tentacles are present for all the horns of the lateral row and joint 13 as well as for the subdorsals of 3 and 12 where they are especially long.

The subdorsals of 6 to 11 are very short, rudimentary, again much as in our Parasa, but their spines are absent, just as on the long horns, which is not the case in our species.

To summarize: the Australian Eucleids belong to the group of the horned Eucleids of Asia, Africa (?)* and America, but differ in having the spines removed from the horns which have not become eversible. It is a distinct and peculiar specialization of one of the highest types of larvae and possibly represents the most modified Eucleid larva on the earth.

PACIFIC COAST COLLECTING. — II.

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LOCALITIES.

Yuma. R. R. hotel; drinking-water detestable. Surroundings chiefly river-flats covered with willow-thickets, and desert. A rocky hill, chaparral, and ranches at a little distance. This place and points in Colorado Desert are likely to be extremely hot.

Indio. R. R. hotel. Desert thickly covered with weeds and chaparral; fruit ranch with artesian well and running water. Mesa and foot of mountains 3 to 4 miles distant. A good place.

Palm Springs. Five miles from station of same name and directly at base of San Jacinto Peak. Inn and fruit ranches. Desert, ranches with fields and orchards, several canyons with wild date-palms, streams, waterfalls, etc. An extremely favorable locality.

Additional places in the Colorado Desert that would probably repay visits are Flowing Well — natural spring, — Salton — 250 ft. below sea-

* I have seen no African larvae, but species of Parasa are recorded from there.